



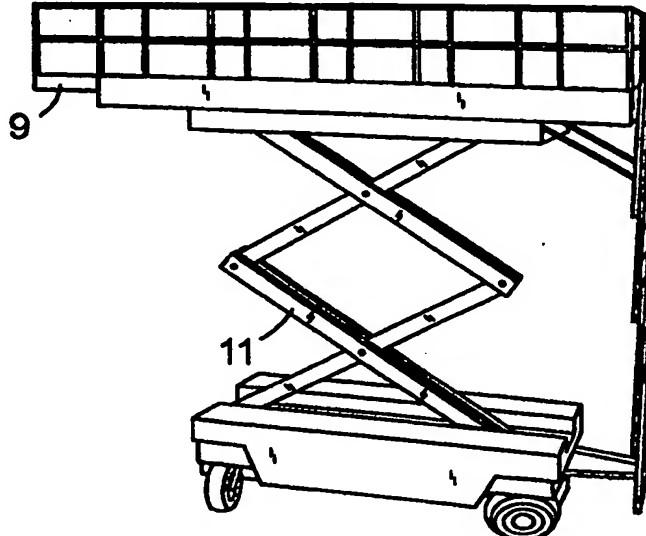
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: ARRANGEMENT FOR VEHICLES

## (57) Abstract

This invention relates to an arrangement for carrying out unlimited movement patterns in a horizontal plane comprising a chassis carried by at least three wheel means, at least one wheel means functioning as a driving and controlling wheel, and the arrangement comprising a computer-based, electronic controlling system which can be programmed for intended purpose, and which is adapted for use in vehicles. According to the invention the arrangement is characterized by the following features: the driving and controlling wheel (1, 3) is arranged partly to be able to rotate about a first axis (5), forming an angle which is greater than 0° but less than 90° with the horizontal line, partly to be able to rotate about a second, essentially vertical axis (6); each driving and controlling wheel (1, 3) is obliquely positioned, has essentially sub-spherical design and is driven by a motor of its own and is separately controlled; the driving and controlling wheel (1, 3) is provided with one or more pulse transducers (12a, b) which are arranged for giving off signals, reflecting one or more parameters, for instance the angle position and speed of the mentioned wheel.



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This invention relates to an arrangement for carrying out unlimited movement patterns in a horizontal plane comprising a chassis carried by at least three wheel means, at least one wheel means functioning as a driving and controlling wheel and the arrangement comprising a computer-based, electronic controlling system, which can be programmed for intended purpose, and which is adapted for use in vehicles.

Such an arrangement is previously known by the American patent 5.609.220. This patent discloses four rectangularly positioned wheels, of which the one pair of diagonally placed wheel comprises driving and controlling wheels. These driving and controlling wheels are of conventional type and arranged in that way that the driving shaft of the wheel, about which the wheel is intended to rotate, is arranged in parallel with the horizontal line. This means that a plane through the wheel itself forms a right angle to the bed/ground that the wheel is rolling on, which has the consequence that the distance between the chassis carried by the known driving and controlling wheels and the bed/ground will become unnecessarily large. This fact in its turn has the effect that a vehicle comprising the known arrangement and a high superstructure becomes unnecessarily unstable, which leads to a great risk for tipping of the vehicle.

The wheel means of the known driving and controlling device is designed in that way that it is like the wheel means of a conventional caster wheel device. This fact has the consequence that the driving and controlling wheel means does not get optimum motion qualities but there is a risk that when attempting to make rapid motion direction changes for the known vehicle, the wheel means will be subjected to tendencies of skidding, which leads to an increased wear of both wheel means and bed/ground.

This invention relates to an improvement of the known arrangement and can accordingly provide a chassis with superstructure (vehicle), which makes possible an extremely smooth motion forwards and a smooth positioning of the vehicle close to an object, for instance when making service jobs on or at an aircraft body.

The improvement of the known arrangement has been made possible by the fact that it has the combination of the features mentioned in the claims.

A preferred embodiment of the invention shall be described in more detail below with reference to the accompanying drawings, where Fig. 1 shows a rectangular chassis with a wheel means in each corner, Fig. 2 shows an operating panel, Fig. 3 shows the chassis according to the invention provided with a new type of working platform, Fig. 4 shows the vehicle according to Fig. 3 but with the working platform in a raised position, and Fig. 5 shows an example of a driving and controlling wheel means for use in the invention.

With reference to Fig. 1 is shown there the chassis according to the invention, which according to this embodiment is rectangular regarding the design and has a wheel means 1-4 in each corner. In this connection the two diagonally positioned wheel means 2,4 are essentially uniform and are composed of conventional caster wheels. The remaining two, 5 diagonally positioned wheel means 1,3 have a special design, are driven and can be turned (swivelled), and therefore these two wheel means are arranged for the driving and controlling (steering) function.

Each wheel means 1,3 is obliquely arranged and has a sub-spherical rolling path. Furthermore, each wheel means 1,3 is driven by an electric motor and can be separately 10 controlled, i.e. steered.

Each of the wheel means 1,3 is intended to be able to rotate about a first axis 5, which functions as a driving shaft, and which forms an angle with a horizontal plane which is greater than 0° but less than 90°, usually 30-45° (see Fig. 5). Furthermore, the wheel means 1,3 has such a design that it can roll round about a second, essentially vertical axis 6 without 15 the chassis moving itself. This ability leads to a varying motion patterns of the chassis and makes possible for the chassis to be able to pass sharp corners without problems. As a matter of fact, the chassis provided with these special wheels 1,3 can be operated out from and into narrow places in a way that has no correspondence with chassis provided with conventional wheels.

20 Equipped with the new arrangement vehicles can be transported forwards in spaces requiring a small turning radius and give that essential advantage that transporting ways can be optimised and minimised and by that can give an essentially better utilization of worthwhile areas.

Besides the unlimited motion patterns which are made possible by the present 25 invention, this invention gives advantages like those that no increased wear arises neither on the wheel nor on the bed/ground when twisting or turning the wheel, since the design of the driving and controlling wheel is such that tendencies of skidding of the same are eliminated.

Another advantage with this invention is that, due to the fact that the wheel is obliquely positioned, the distance between the chassis and the bed/ground can be small, 30 relatively spoken, which makes a vehicle equipped with this new wheel arrangement more stable than known vehicles in the field. Furthermore, the wheel means according to the invention are designed in that way that they can take their positions while the chassis is completely immovable, and this means that it is possible to reach an object on the shortest way.

As appears from Fig. 5 the rolling point P of the wheel means against the bed/ground is laterally positioned in relation to the vertical axis 6. This means that when turning the wheel means one revolution about the axis 6, a circle will be formed on the bed/ground by the rolling point P of the wheel means.

5       The gear ratio between the axes 5 and 6 is related to the diameter D of the wheel and the angle between the axis 5 and the horizontal plane. In order to show this fact with an example, we can for the sake of simplicity assume that the gear ratio between the axes 5 and 6 is 1:1. That should mean that the wheel in its rolling plane should have the same circumference ( $\pi \times D$ ) as the circle that is formed on the bed/ground by the rolling point P  
10      during a turning of one revolution of the wheel means about the axis 6. In such a case the distance A should be the same as 0,5 D (does not apply for Fig. 5).

Of course, the gear ratio between the axes 5 and 6 can be varied.

As mentioned previously a main purpose of this invention is a further development of the known arrangement in order to satisfy the requirements about new operation and  
15      positioning possibilities of the vehicle which is provided with the arrangement.

The new chassis comprises a computer-based, electronic controlling system, which can be programmed in different ways, and which in combination with the two special wheels provides unlimited motion possibilities of the new chassis. This is made possible by the fact that each driving and controlling wheel is provided with one or more pulse transducers, which  
20      all the time give signals to the computer adapted for use in vehicles. These signals for instance comprising the angle position and the speed of the wheel means is treated with lightning rapidity by the computer which compares the information with the motion schedule, programmed in advance, and if that is necessary gives an order about correction to the wheel means in form of controlling and driving impulses. In Fig. 5 are indicated partly a first  
25      transducer 12a, sensing the driving shaft 6, partly a second transducer 12b, sensing the controlling function of the wheel means.

It has appeared that the positive effects of the new chassis especially have been able to be achieved by the fact that the two mentioned special wheels are especially receptive for the controlling and driving impulses from the electronic computer system and respond  
30      accordingly with lightning rapidity on the impulses.

Due to the unique combination special wheel and electronic, computer-based controlling system it is possible with the new chassis not only to achieve the four basic controlling ways, namely Ackerman Control, Parallel Control, Antiparallel Control and Rotation of the chassis about its centre axis, but it is also possible to carry out a combination

of several control ways during driving, for instance rotation with parallel control simultaneously.

In Fig. 2 is shown an operation panel by means of which the chassis can be driven and controlled. Thus, on this panel there is among others the means 7 for control of the 5 chassis and the means 8 for driving of the chassis forwards and backwards.

On the chassis can be placed different types of superstructures. A preferred superstructure is shown in Fig. 3,4 and this superstructure comprises a raisable and lowerable working platform 10 provided with a prolongation part 9. This working platform is intended to be raised and lowered by means of an articulated lift 11, hydraulically driven, and has such 10 a design that it can be prolonged and become no less than nine meters long without being unstable. The raising of the platform and the pushing out and the pulling in of the prolongation part of the platform, respectively, is preferably made in a hydraulic way, the operation being made from the previously mentioned operation panel.

The chassis and/or the working platform (vehicle) is provided with a collision 15 protection in the form of photo cells, which break all functions if the vehicle comes too close any object. Due to that fact the vehicle stops immediately.

The new invention has been tested for a special field of use, namely when making service jobs on the upper side of an aircraft body. In this connection the operation panel is adjusted for optional movement, whereafter the vehicle is driven up along and parallel with 20 the aircraft body, so that the vehicle takes a position close to the rear portion of the aircraft wing. Thereafter, the working platform is raised to intended height, whereafter the vehicle is driven further towards the aircraft body so that the working platform takes a position above the aircraft body. Finally, the platform is pushed out to full length, whereby jobs can be done along a great part of the upper side of the aircraft body.

25 It should be clear for everyone that this operation of the vehicle close to the aircraft body is a very delicate task and should be almost impossible with a conventional vehicle.

The new vehicle also has transducers sensing the platform height and adapt the movement velocity to this fact. There are also transducers sensing overload and an inclination which is too large, which immediately leads to an automatic stop.

30 When making positioning movements with the new chassis close to an object, there is a requirement to have a large angle between the axis 5 and the horizontal plane. If in contrast to that, it is a question about linear driving with the chassis, the angle between the axis 5 and the horizontal plane shall be small.

Thus, the special form of the wheel facilitates the positioning of a chassis at an object. Furthermore, the wheel means can take positions while the chassis is completely immovable and this fact means that the object can be reached in the shortest and quickest way.

- 5 The invention is of course not limited to the mentioned embodiment but can be modified within the scope of the following claims.
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**Claims**

1. An arrangement for carrying out unlimited movement patterns in an horizontal plane comprising a chassis, carried by at least three wheel means, at least one wheel means functioning as a driving and controlling wheel, and the arrangement comprising a computer-based, electronic controlling system, which can be programmed for intended purpose and which is adapted for use in vehicles, **c h a r a c t e r i z e d** by the combination of the following features:
  - The driving and controlling wheel (1,3) is arranged partly to be able to rotate about a first axis (5), forming an angle which is greater than 0° but less than 90° with the horizontal line, partly to be able to rotate about a second, essentially vertical axis (6);
  - Each driving and controlling wheel (1,3) is obliquely positioned, and has essentially sub-spherical design and is driven by a motor of its own and can be separately controlled;
  - The driving and controlling wheel (1,3) is provided with one or more pulse transducers (12a, b) which are arranged for giving off signals, reflecting one or more parameters, for instance the angle position and speed of the mentioned wheel;
  - The computer-based controlling system is arranged for receiving signals from the pulse transducers (12a, b) all the time and for comparing this information with the movement schedule, programmed in advance, and which, if necessary, gives an order of correction to the wheel (1,3) in the form of controlling and driving impulses.
- 20 2. A vehicle comprising the arrangement according to claim 1 and a superstructure in the form of a platform, having a main part, **c h a r a c t e r i z e d** by the combination of the following features:
  - The platform (10) is raisable and lowerable by means of an articulated lift (11), hydraulically driven, and has a prolongation part (9), which in a hydraulic way can be pushed out and pulled in, in relation to the main part;
  - The movements of the vehicle including those of the superstructure are made by an operation panel positioned on the vehicle.
3. A vehicle according to claim 2, **c h a r a c t e r i z e d** in that it is provided with a collision protection in the form of photo cells, which break all functions if the vehicle comes too close any object.
- 30 4. A vehicle according to claim 2 or 3, **c h a r a c t e r i z e d** in that it is partly provided with transducers sensing the platform height and adapt the movement velocity to that, partly transducers sensing overload and inclination.

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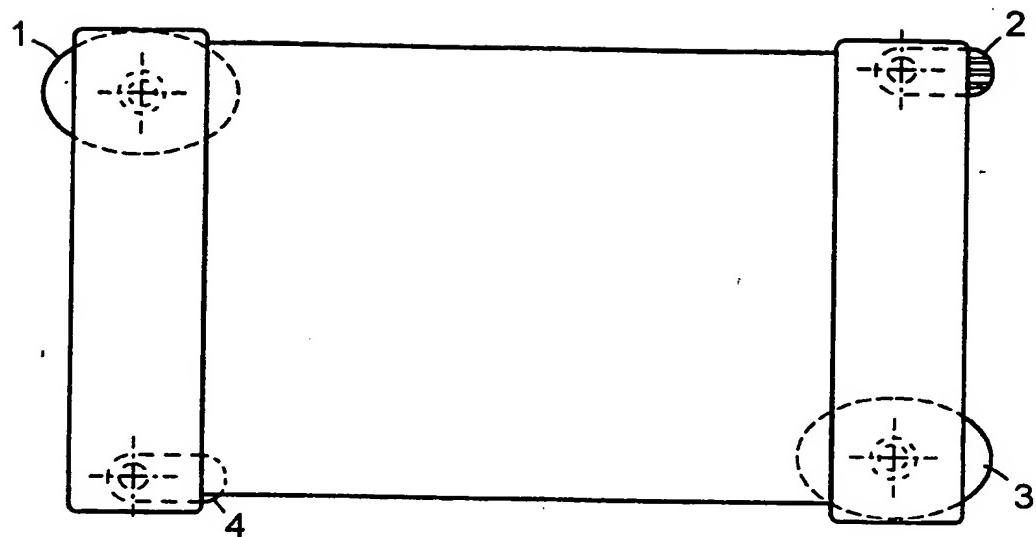


FIG. 1

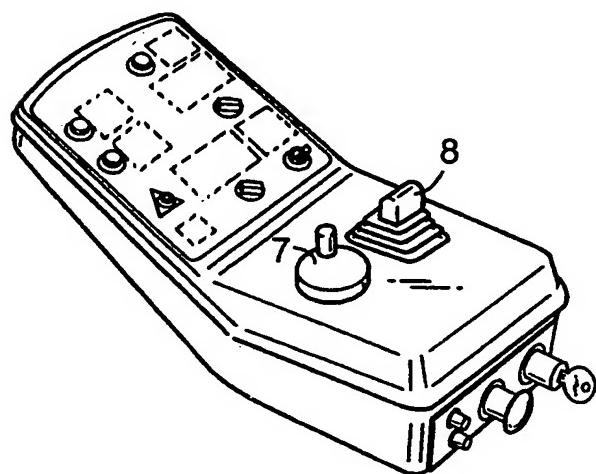


FIG. 2

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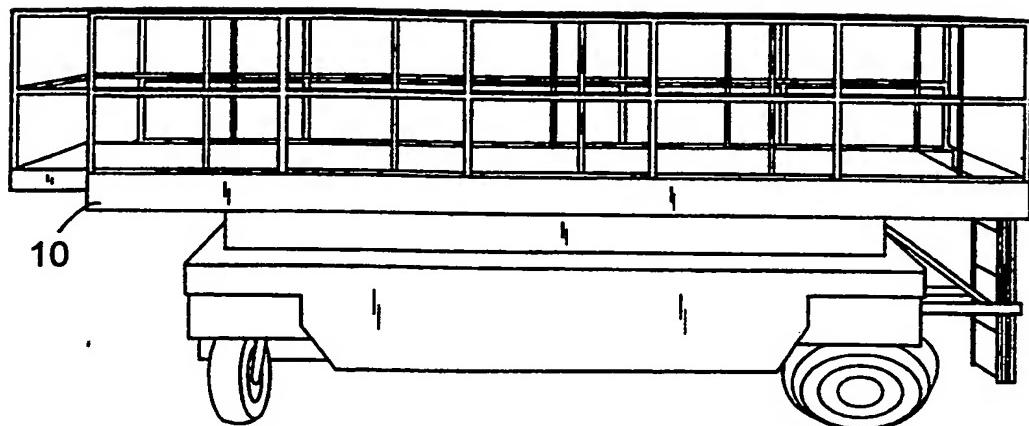


FIG. 3

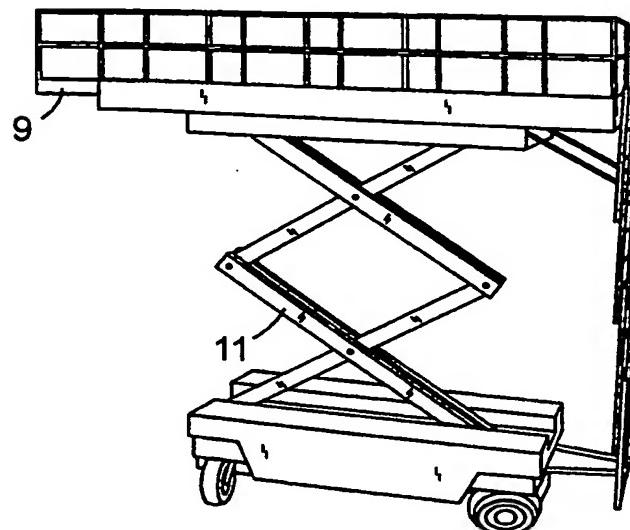


FIG. 4

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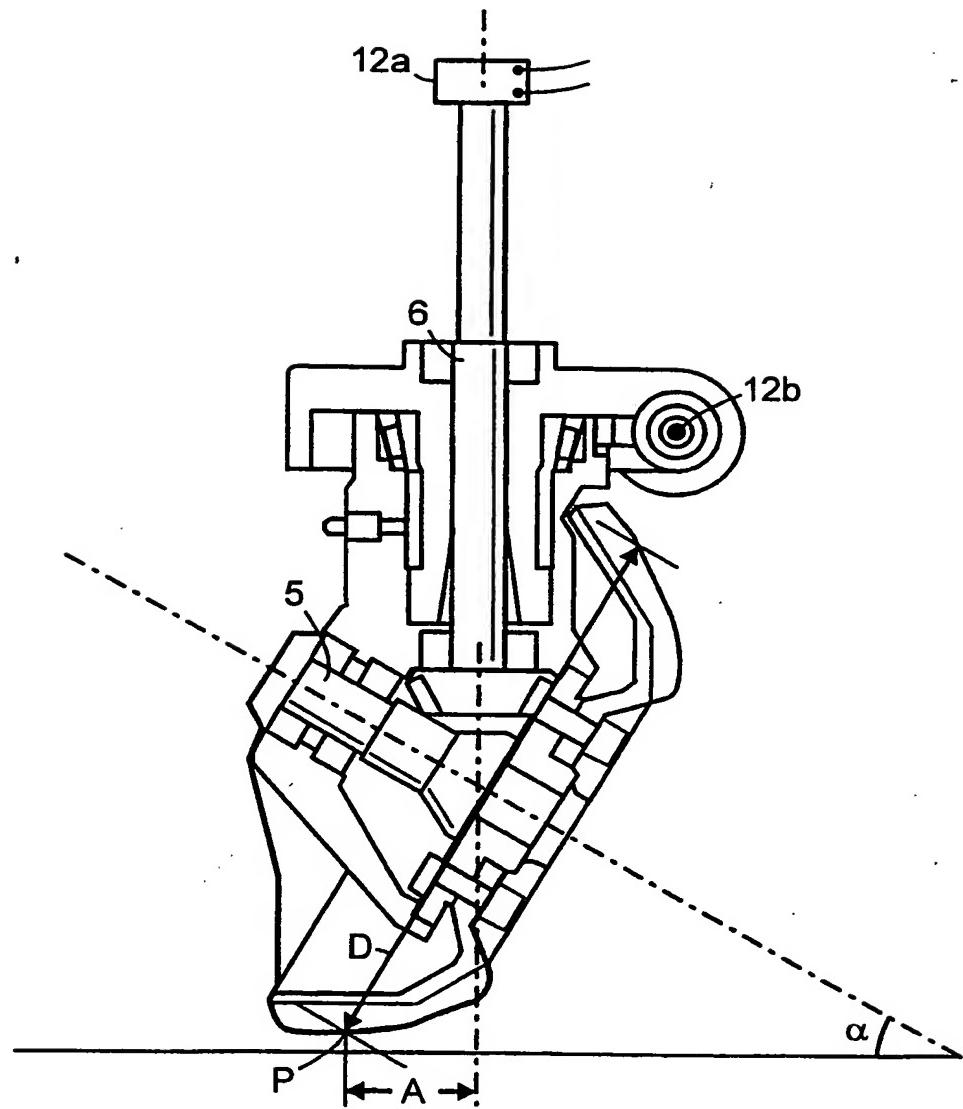


FIG. 5

1  
INTERNATIONAL SEARCH REPORTInternational application No.  
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## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B62D 61/00, B60K 17/30, B66F 7/08  
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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5609220 A (MORIYA ET AL), 11 March 1997 (11.03.97), column 5, line 33 - column 6, line 38, figures 4,16, abstract	1
Y	--	2
A	WO 8803492 A1 (SEGERLJUNG, MAX), 19 May 1988 (19.05.88), figure 2, abstract	1
Y	--	
Y	US 3820631 A (KING AT AL), 28 June 1974 (28.06.74), column 2, line 33 - line 53, figure 1, abstract	2
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 Further documents are listed in the continuation of Box C. See patent family annex.

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## INTERNATIONAL SEARCH REPORT

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## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5083629 A (CHANG), 28 January 1992 (28.01.92), column 2, line 66 - column 3, line 36, figure 1, abstract	1
Y	--	2
A	EP 0850822 A1 (EXPRESSO DEUTSCHLAND TRANSPORTGERÄTE GMBH), 1 July 1998 (01.07.98), figures 1,4, abstract	1-4
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## INTERNATIONAL SEARCH REPORT

Information on patent family members

02/08/99

International application No.  
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Patent document cited in search report	Publication date		Patent family member(s)	Publication date
US 5609220 A	11/03/97		DE 4394316 T JP 2599075 B JP 6072352 A US 5699873 A WO 9405539 A JP 6305440 A	20/07/95 09/04/97 15/03/94 23/12/97 17/03/94 01/11/94
WO 8803492 A1	19/05/88		AT 95769 T AU 8271087 A DE 3787812 D,T DK 368788 A EP 0414671 A,B SE 0414671 T3 FI 892184 A JP 2500900 T JP 2602867 B SE 8604781 D US 4995679 A	15/10/93 01/06/88 05/05/94 01/07/88 06/03/91  05/05/89 29/03/90 23/04/97 00/00/00 26/02/91
US 3820631 A	28/06/74		AU 473837 B AU 6631674 A CA 986856 A GB 1421307 A	01/07/76 11/09/75 06/04/76 14/01/76
US 5083629 A	28/01/92		NONE	
EP 0850822 A1	01/07/98		DE 19700909 A DE 29700495 U	02/07/98 07/05/97